**Polygon**: A 2D shape with straight sides

**Regular polygon**: A polygon in which all angles are equal, and all sides are equal

*Keep it simple to start with and only use* ***convex*** *polygons!*

### Task 1

* Construct a pentagon.
* Choose one of the vertices. Draw all possible diagonals from this corner.
* How can you use this **dissection** to help work out the total of the interior angles in a pentagon?
* What is the total of the five interior angles?
* Repeat for a hexagon, heptagon and octagon.
* Copy and complete the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Polygon** | **Number of sides** | **Total of interior angles** |  |  |
| Octagon |  |  |  |  |
| Heptagon |  |  |  |  |
| Hexagon |  |  |  |  |
| Pentagon |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* Find a position-to-term rule (in words) for finding the total of the angles in a polygon
* Let ‘n’ be the number of sides. Write your rule using algebra (i.e. a formula for converting the number of sides into the total of the angles)
* Check that your formula works for a triangle and a quadrilateral (i.e. n = 3 and n = 4)
* Extend the table to include results for a triangle and a quadrilateral

### Task 2

If you have any **regular** polygon, how can you find the size of one of the interior angles?

Label the fourth column of the table ‘interior angle if regular’. Fill in the results for your polygons.

### Task 3

An exterior angle of a polygon is created by extending a side. The diagram of a regular hexagon here has an exterior angle shaded.

* How can you find the size of the exterior angle in this regular hexagon?
* What is the total of the exterior angles in this hexagon?
* Label the fifth column of the table ‘exterior angle if regular’. Find the results for your polygons.

### Task 4

Now consider any polygon, not just regular ones. What is the total of the exterior angles in a triangle, in a quadrilateral, in a pentagon, etc?

* Convince yourself (think)
* Convince a friend (explain in words)
* Convince a penfriend (explain in writing – you could use diagrams to help)
* Convince a teacher

### Task 5

* Draw a circle and carefully mark its centre.
* Draw a line from the centre to any point on the circumference
* Measure an angle of 72º and draw another line to the circumference.
* Repeat until you get back to the starting line.
* Join each of the five points on the circumference to their neighbours – with straight lines.
* What shape have you constructed?
* Work out how to construct an octagon using a circle as a starting point.

**Key questions**

How can you find the total of all the interior angles in a polygon?

How can you find the size of one interior angle in a regular polygon?

How can you find the size of one exterior angle in a regular polygon? Is there a quicker way?

What is the total of the exterior angles in any polygon?

A regular polygon has an exterior angle of 36º. How many sides does it have?

Find all the angles in this diagram, which shows an isosceles triangle inscribed in a regular polygon